IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :

Shoji MIYAZAKI et al. : **Attn: BOX PCT**

Serial No. NEW : **Docket No. 2001-1063A**

Filed August 3, 2001 :

BIOSENSOR
[Corresponding to PCT/JP00/08508
Filed December 1, 2000]

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents,
Washington, DC 20231

Sir:

Prior to examination of the above-referenced U.S. patent application please amend the application as follows:

IN THE SPECIFICATION

Please amend the specification as follows:

Please replace the paragraph beginning at page 3, line 7, line 15, with the following rewritten paragraph:

Further, in the construction of the conventional biosensor, after the reagent layer 10 is formed by spreading a solution including glucose oxidase and an electron acceptor over the electrodes and then drying the solution, formation of the surfactant layer 11 on the reagent layer 10 requires a step of applying and spreading a solution including a surfactant so as to cover the reagent layer 10, and a step of drying the surfactant layer. Therefore, the process of manufacturing the biosensor takes much time, resulting in poor productivity.

Please replace the paragraph beginning at page 11, line 6, line 15, with the following rewritten paragraph:

The kinds of surfactants which can be expected to have the above-mentioned effects when being mixed into the insulating film (classified as hydrophilic groups) are as follows: anionic surfactants such as carboxylate, sulfonate, ester phosphate, and the like; cationic surfactants such as primary amine salt, secondary amine salt, tertiary amine salt, quaternary ammonium salt, and the like; ampholytic surfactants such as amino-acid base surfactants, betaine base surfactants, and the like; and non-ionic surfactants such as polyethylene glycol base surfactants, polyalcohol base surfactants, and the like.

IN THE CLAIMS

Please amend the claims as follows:

6. (Amended) A biosensor as defined in Claim 4 wherein

the thickness of the surfactant or the resin having a hydrophilic polar group, which covers the film, is several tens of angstroms or more.

11. (Amended) A biosensor as defined in Claim 1 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

12. (Amended) A biosensor as defined in Claim 1 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

Please add the following new claims:

14. A biosensor as defined in Claim 5 wherein

the thickness of the surfactant or the resin having a hydrophilic polar group, which covers the film, is several tens of angstroms or more.

15. A biosensor as defined in Claim 2 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

16. A biosensor as defined in Claim 3 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

17. A biosensor as defined in Claim 4 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

18. A biosensor as defined in Claim 5 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

19. A biosensor as defined in Claim 6 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

20. A biosensor as defined in Claim 14 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

21. A biosensor as defined in Claim 7 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

22. A biosensor as defined in Claim 8 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

23. A biosensor as defined in Claim 9 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

24. A biosensor as defined in Claim 10 wherein

the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

25. A biosensor as defined in Claim 2 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

26. A biosensor as defined in Claim 3 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

27. A biosensor as defined in Claim 4 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

28. A biosensor as defined in Claim 5 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

29. A biosensor as defined in Claim 6 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

30. A biosensor as defined in Claim 14 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

31. A biosensor as defined in Claim 7 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

32. A biosensor as defined in Claim 8 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

33. A biosensor as defined in Claim 9 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

34. A biosensor as defined in Claim 10 wherein

the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

35. A biosensor as defined in Claim 25 wherein

the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

36. A biosensor as defined in Claim 26 wherein

the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

37. A biosensor as defined in Claim 27 wherein

the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

38. A biosensor as defined in Claim 28 wherein

the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

39. A biosensor as defined in Claim 29 wherein

the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

40. A biosensor as defined in Claim 30 wherein

the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

41. A biosensor as defined in Claim 31 wherein

the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

42. A biosensor as defined in Claim 32 wherein

the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

43. A biosensor as defined in Claim 33 wherein

the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

44. A biosensor as defined in Claim 34 wherein

the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

IN THE ABSTRACT

Please replace the original abstract with the substitute abstract.

REMARKS

The present Preliminary Amendment is submitted to delete the multiple dependency of the claims, thereby placing such claims in condition for examination and reducing the required PTO filing fee and also to make minor editorial changes so as to generally improve the form of the specification.

Attached hereto is a marked-up version of the changes made to the specification, claims and abstract by the current Preliminary Amendment. The attached page is captioned "**Version With Markings to Show Changes Made**".

Respectfully submitted,

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August 3, 2001

THE COMMISSIONER IS AUTHORIZED TO CHARGE ANY DEFICIENCY IN THE FEES FOR THIS PAPER TO DEPOSIT ACCOUNT NO. 23-0975

Version with Markings to Show Changes Made

ABSTRACT

An electrode layer comprising a working electrode 1 and a counter electrode 2, and a reagent layer 10 are formed on an insulating support 5 and, further, a spacer 7 having a long and narrow cut-out portion on the reagent layer 10 is bonded to a cover 6 having an air hole 9 to form a cavity 12 that sucks blood as a liquid sample by capillary phenomenon, and a portion of side walls of the spacer 7 and the cover 6, which side walls face the cavity 12, is subjected to a treatment for making the portion itself have hydrophilicity.

In the biosensor constructed as described above, when blood is sucked [from] into the cavity 12 by capillary phenomenon, the suction is promoted, and the performance of the sensor is improved. Further, the process of manufacturing the sensor is simplified, resulting in increased productivity.

the blood reacts with the reagent layer 10 on the electrodes while dissolving the reagent layer 10, the surfactant layer 11 prevents the reagent layer 10 from dissolving into the blood, and this causes variations in the sensitivity of the sensor or in the measured value, resulting in a detrimental effect on the performance of the sensor.

Further, in the construction of the conventional biosensor, after the reagent layer 10 is formed by spreading a solution including [a reagent] glucose oxidase and an electron acceptor over the electrodes and then drying the solution, formation of the surfactant layer 11 on the reagent layer 10 requires a step of applying and spreading a solution including a surfactant so as to cover the reagent layer 10, and a step of drying the surfactant layer. Therefore, the process of manufacturing the biosensor takes much time, resulting in poor productivity.

The present invention is made to solve the above-described problems and has for its object to provide a biosensor that can promote the flow of blood into the cavity to quickly and sufficiently draw the blood into the cavity, without forming a surfactant layer on the reagent layer.

DISCLOSURE OF THE INVENTION

According to Claim 1 of the present invention, in a biosensor which is provided with a cavity into which a liquid sample is drawn by capillary phenomenon and is able to analyze a

terephthalate, polycarbonate or the like, and the cover 6 and the spacer 7 are constituted by the insulating film. Thereby, the wettability of the side walls of the cavity 12 is increased, and the blood sampled from the suction inlet 8 can be quickly and reliably drawn into the cavity 12.

The kinds of surfactants which can be expected to have the above-mentioned effects when being mixed into the insulating film (classified as hydrophilic groups) are as follows: anionic surfactants such as carboxylate, sulfonate, carboxylate, ester phosphate, and the like; cationic surfactants such as primary amine salt, secondary amine salt, tertiary amine salt, quaternary ammonium salt, and the like; ampholytic surfactants such as amino-acid base surfactants, betaine base surfactants, and the like; and non-ionic surfactants such as polyethylene glycol base surfactants, polyalcohol base surfactants, and the like.

Further, as materials of the cover 6 and the spacer 7 into which the above-mentioned surfactants can be mixed, there are, besides those mentioned above, polybutylene terephthalate, polyamide, polyvinyl chloride, polyvinylidene chloride, polyimide, nylon, and the like.

As described above, according to the first embodiment of the present invention, the side walls facing the cavity 12 into which blood is drawn, i.e., the portions of the cover 6 and the spacer 7 facing the cavity 12, are made to have hydrophilicity by mixing a chemical having surface activity such as a surfactant or the

Version with Markings to Show Changes Made

6. A biosensor as defined in Claim 4 [or 5] wherein

the thickness of the surfactant or the resin having a hydrophilic polar group, which covers the film, is several tens of angstroms or more.

7. A biosensor as defined in Claim 1 wherein

the surface of at least a portion of the side walls forming the cavity is chemically reformed.

8. A biosensor as defined in Claim 7 wherein

a hydrophilic functional group is formed on the surface of at least a portion of the side walls facing the cavity, by subjecting the surface to any of the following treatments: plasma discharge, coupling reaction, ozone treatment, and UV treatment.

9. A biosensor as defined in Claim 1 wherein

the surface of at least a portion of the side walls facing the cavity is made of a rough surface.

10. A biosensor as defined in Claim 9 wherein

a rough surface is formed at the surface of at least a portion of the side walls facing the cavity, by subjecting the surface to any of the following treatments: sand blasting, electric discharge, non-glare treatment, mat treatment, and

chemical plating.

11. A biosensor as defined in any of Claims 1 to 10 wherein the surface of the side wall, on which the reagent that reacts with the liquid sample is formed, has hydrophilicity.

12. A biosensor as defined in any of Claims 1 to 10 wherein the surface of the side wall, on which electrodes that detect the reaction between the liquid sample and the reagent are formed, has hydrophilicity.

13. A biosensor as defined in Claim 12 wherein the surface of the support is made of a rough surface, and the level of the rough surface to be formed is 0.001μm to 1μm.

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BIOSENSOR
[Corresponding to PCT/JP00/08508
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LETTER RE PROPOSED DRAWING AMENDMENTS

Assistant Commissioner for Patents,
Washington, D.C.

Sir:

Enclosed herewith is a photocopy of Figs. 2 and 3 marked in red to indicate proposed drawing amendments thereto.

The Examiner is requested to approve such proposed drawing amendments, and after allowance of this application, formal drawings incorporating such amendments will be filed.

Respectfully submitted,

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Fig.2

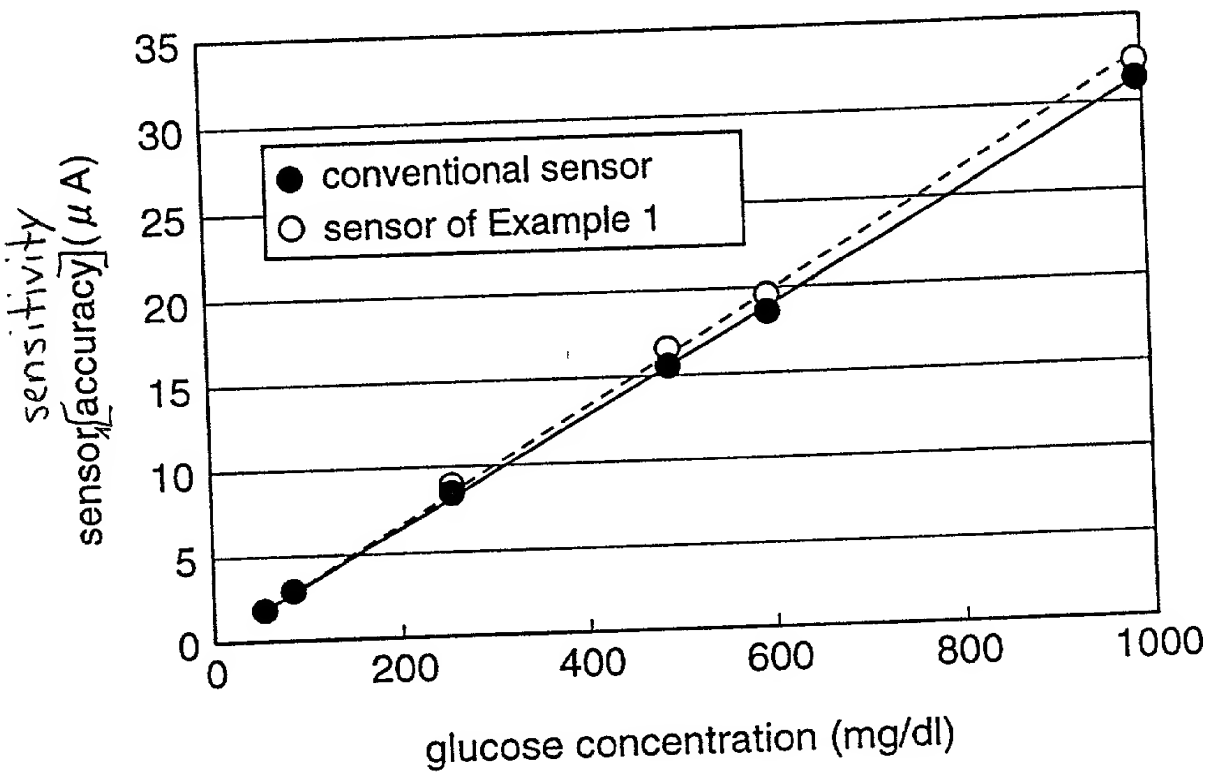
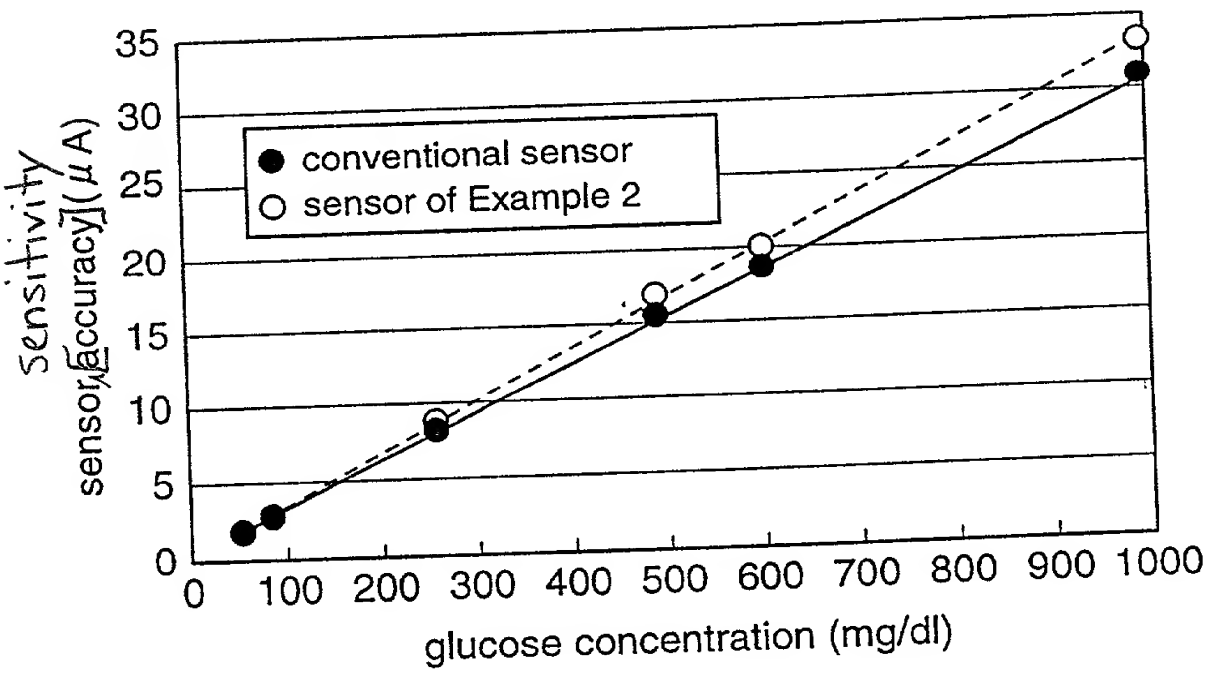

sensitivity
sensor[accuracy](μA)
35
30
25
20
15
10
5
0
0
200
400
600
800
1000
conventional sensor
sensor of Example 1
glucose concentration (mg/dl)

Fig.3


sensitivity
sensor[accuracy](μA)
35
30
25
20
15
10
5
0
0
100
200
300
400
500
600
700
800
900
1000
conventional sensor
sensor of Example 2
glucose concentration (mg/dl)